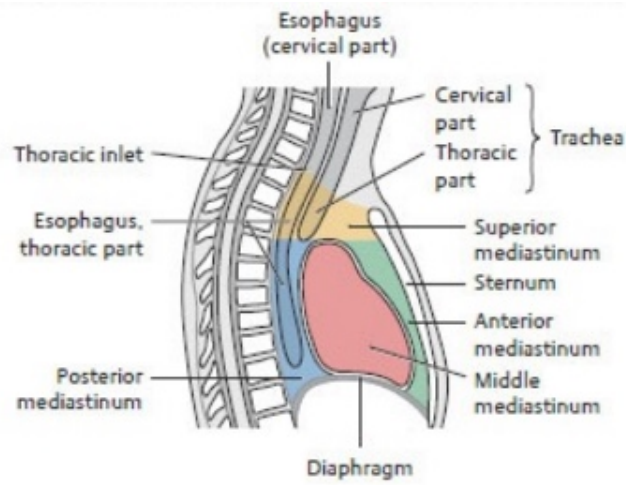
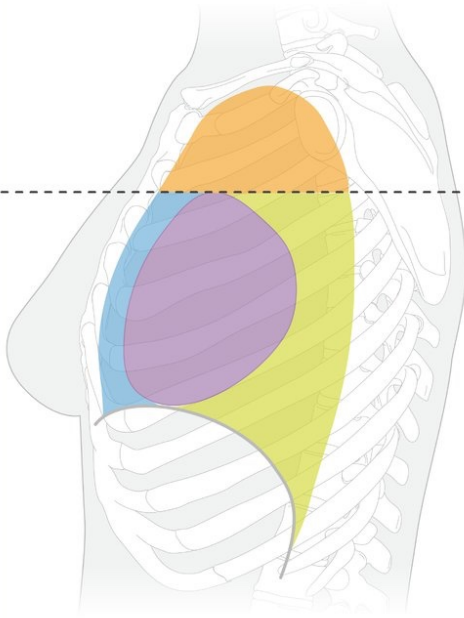


**Mediastinum** is a region in thorax between right and left pulmonary cavities. Sternum and costal cartilages of ribs 1-7 form anterior boundary, and thoracic vertebrae form posterior boundary.

## Regions of mediastinum



	Inferior mediastinum			
	Superior mediastinum ●	Anterior ●	Middle ●	Posterior ●
Organs	<ul style="list-style-type: none"> <li>• Thymus</li> <li>• Trachea</li> <li>• Esophagus</li> </ul>	<ul style="list-style-type: none"> <li>• Thymus, inferior aspects (especially in children)</li> </ul>	<ul style="list-style-type: none"> <li>• Heart</li> <li>• Pericardium</li> </ul>	<ul style="list-style-type: none"> <li>• Esophagus</li> </ul>
Arteries	<ul style="list-style-type: none"> <li>• Aortic arch</li> <li>• Brachiocephalic trunk</li> <li>• Left common carotid a.</li> <li>• Left subclavian a.</li> </ul>	<ul style="list-style-type: none"> <li>• Smaller vessels</li> </ul>	<ul style="list-style-type: none"> <li>• Ascending aorta</li> <li>• Pulmonary trunk and brs.</li> <li>• Pericardiophrenic aa.</li> </ul>	<ul style="list-style-type: none"> <li>• Thoracic aorta and brs.</li> </ul>
Veins and lymph vessels	<ul style="list-style-type: none"> <li>• Superior vena cava</li> <li>• Brachiocephalic vv.</li> <li>• Thoracic duct and right lymphatic duct</li> </ul>	<ul style="list-style-type: none"> <li>• Smaller vessels, lymphatics, and l.n.</li> </ul>	<ul style="list-style-type: none"> <li>• Superior vena cava</li> <li>• Azygos v.</li> <li>• Pulmonary vv.</li> <li>• Pericardiophrenic vv.</li> </ul>	<ul style="list-style-type: none"> <li>• Azygos v.</li> <li>• Accessory hemiazygos and hemiazygos vv.</li> <li>• Thoracic duct</li> </ul>
Nerves	<ul style="list-style-type: none"> <li>• Vagus nn.</li> <li>• Left recurrent laryngeal n.</li> <li>• Cardiac nn.</li> <li>• Phrenic nn.</li> </ul>	<ul style="list-style-type: none"> <li>• None</li> </ul>	<ul style="list-style-type: none"> <li>• Phrenic nn.</li> </ul>	<ul style="list-style-type: none"> <li>• Vagus nn.</li> </ul>



Superior mediastinum			
Organs	Vessels	Nerves	Lymphatic vessels and lymph nodes
<ul style="list-style-type: none"> <li>• Thymus</li> <li>• Inferior trachea, carina, and main bronchi</li> <li>• Esophagus</li> </ul>	<ul style="list-style-type: none"> <li>• Arch of aorta</li> <li>• Brachiocephalic trunk</li> <li>• Left common carotid artery</li> <li>• Left subclavian artery</li> <li>• Internal thoracic arteries</li> <li>• Internal thoracic veins</li> <li>• Superior vena cava</li> <li>• Brachiocephalic veins</li> </ul>	<ul style="list-style-type: none"> <li>• Vagus nerves</li> <li>• Left recurrent laryngeal nerve</li> <li>• Cardiac nerves</li> <li>• Phrenic nerves</li> </ul>	<ul style="list-style-type: none"> <li>• Left thoracic duct</li> <li>• Right lymphatic duct</li> <li>• Bronchomediastinal lymph trunks</li> <li>• Anterior mediastinal lymph nodes</li> <li>• Posterior mediastinal lymph nodes</li> </ul>

Anterior mediastinum			
Organs	Vessels	Nerves	Lymph nodes
	<ul style="list-style-type: none"> <li>• Internal thoracic vessels</li> </ul>		<ul style="list-style-type: none"> <li>• Parasternal lymph nodes</li> </ul>

Middle mediastinum			
Organ	Vessels	Nerves	Lymphatic vessels and lymph nodes
<ul style="list-style-type: none"> <li>• Heart and pericardium</li> </ul>	<ul style="list-style-type: none"> <li>• Ascending aorta</li> <li>• Pulmonary trunk</li> <li>• Superior vena cava</li> <li>• Inferior vena cava</li> <li>• Azygos vein</li> <li>• Pulmonary veins</li> <li>• Pericardiophrenic vessels</li> </ul>	<ul style="list-style-type: none"> <li>• Phrenic nerves</li> </ul>	

Posterior mediastinum			
Organ	Vessels	Nerves	Lymphatic vessel
<ul style="list-style-type: none"> <li>• Esophagus</li> </ul>	<ul style="list-style-type: none"> <li>• Thoracic aorta</li> <li>• Azygos vein</li> <li>• Hemiazygos vein</li> </ul>	<ul style="list-style-type: none"> <li>• Vagus nerves</li> <li>• Sympathetic trunks</li> <li>• Splanchnic nerves</li> </ul>	<ul style="list-style-type: none"> <li>• Thoracic duct</li> </ul>

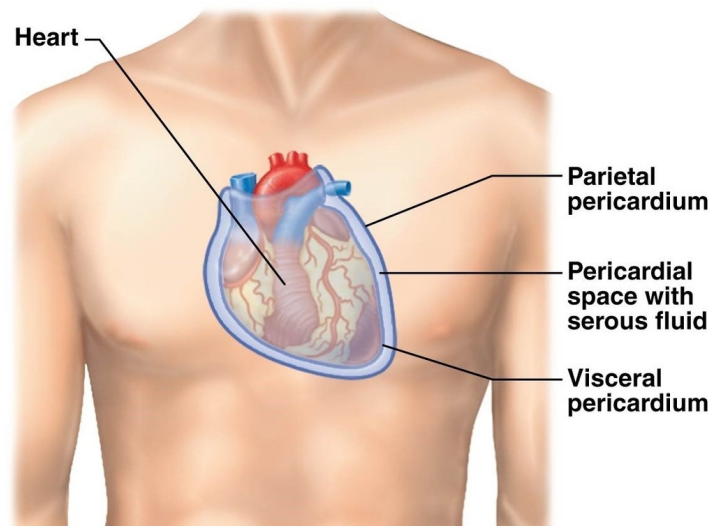
## • Inferior mediastinum (anterior, middle and posterior)

### ◦ anterior

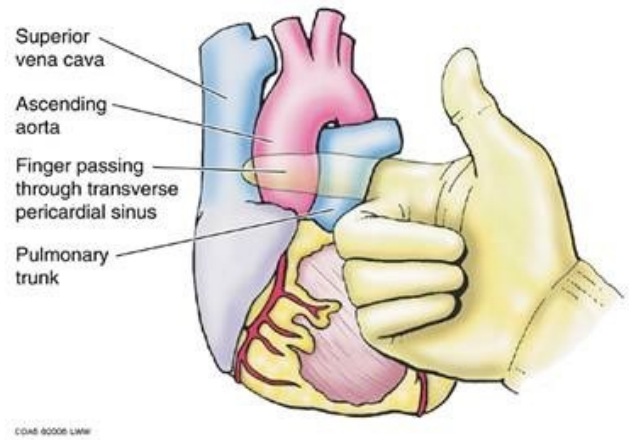
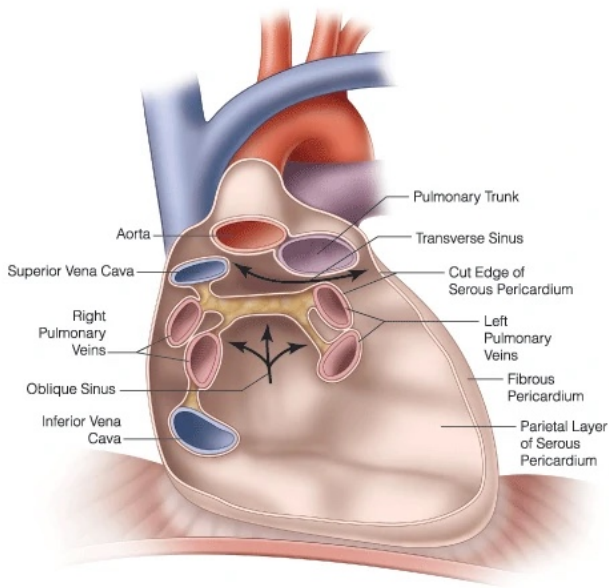
- thymus is a gland of immune system, responsible for maturation of T-lymphocytes

### ◦ middle (the largest section)

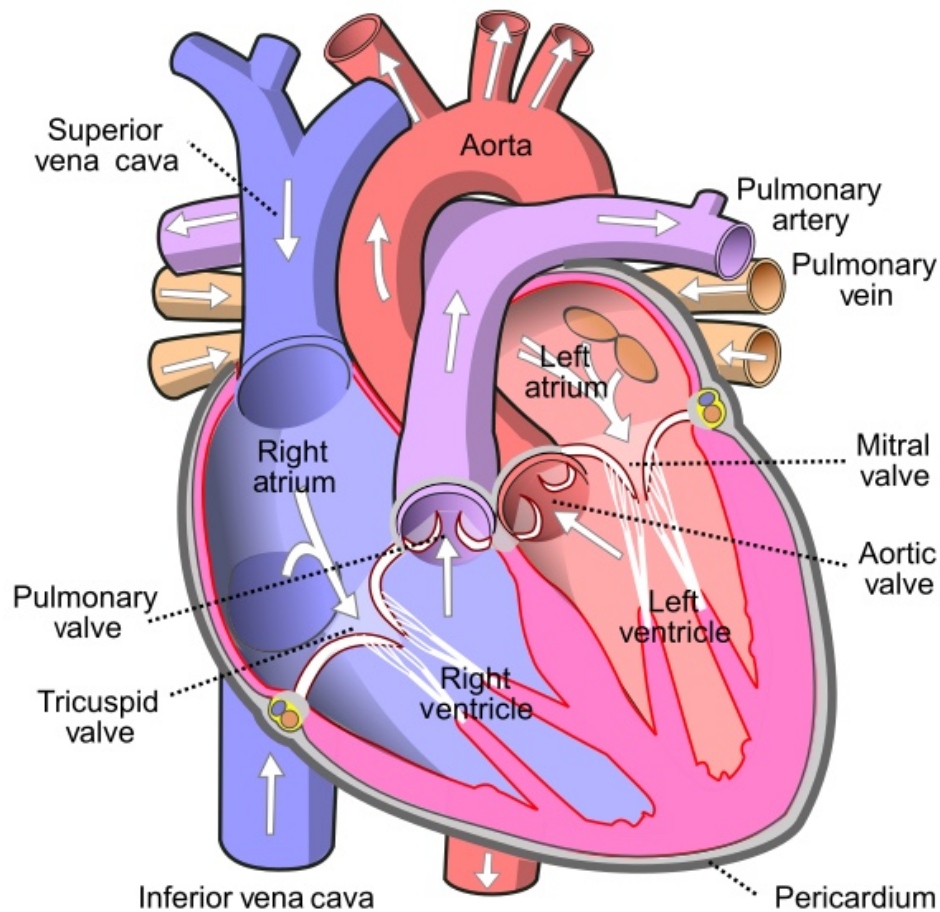
- **pericardium**, double layered fibroserous membrane, forms pericardial sac that surrounds heart and origins of great vessels
  - composed of 2 layers:
    - fibrous pericardium: tough inelastic connective tissue.
    - serous pericardium: consists of visceral and parietal layers
      - parietal layer lines inner surface of parietal pericardium
      - visceral layer firmly adheres to outer surface of the heart as epicardium.
  - blood supply: branches of internal thoracic a.
  - veins: drain to superior vena cava
  - innervated by: vagus (CN X) and phrenic (C3-C5) and branches from sympathetic trunks



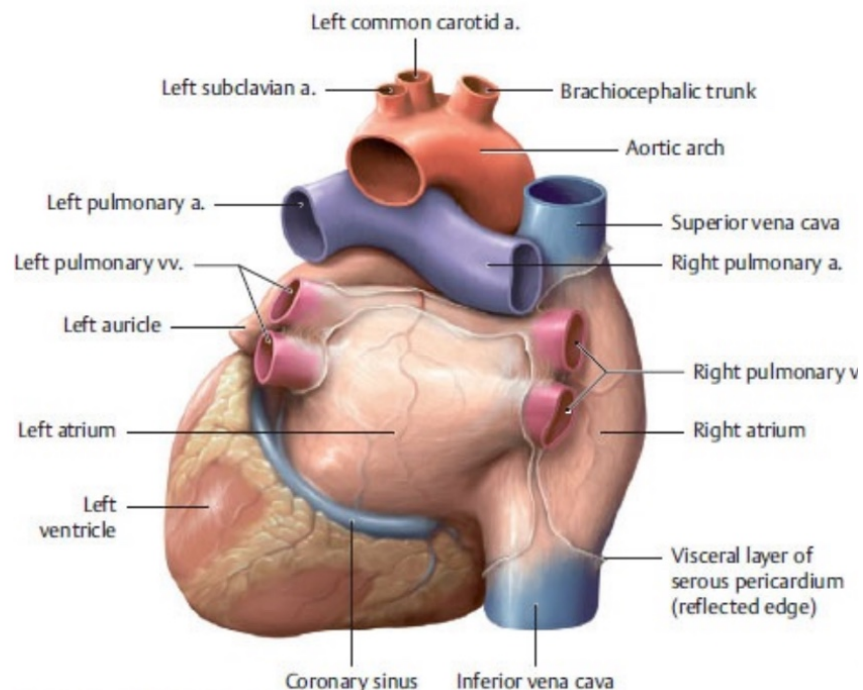
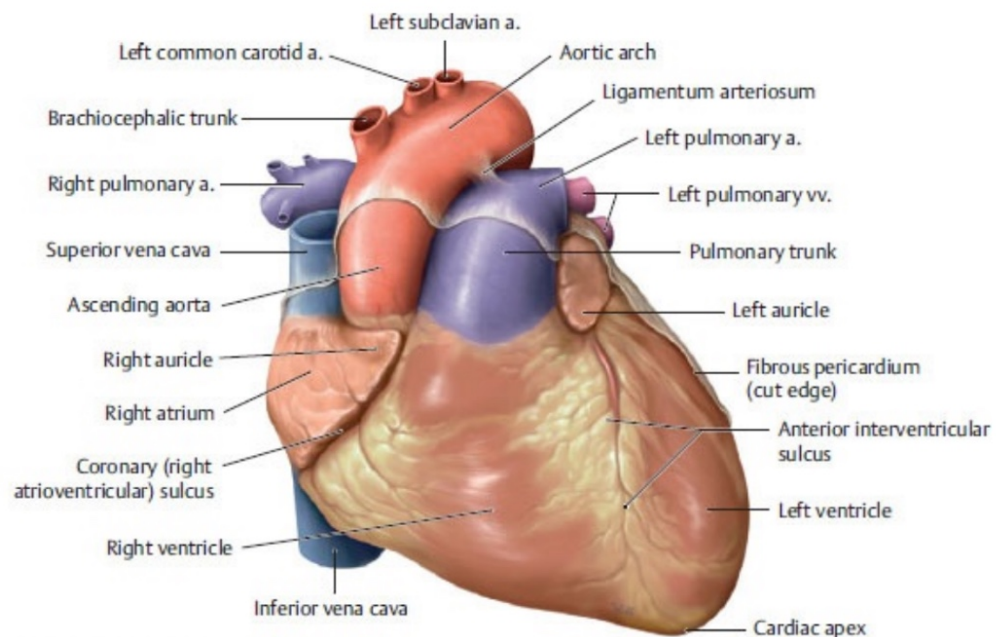
**Serous Membranes of the Heart**

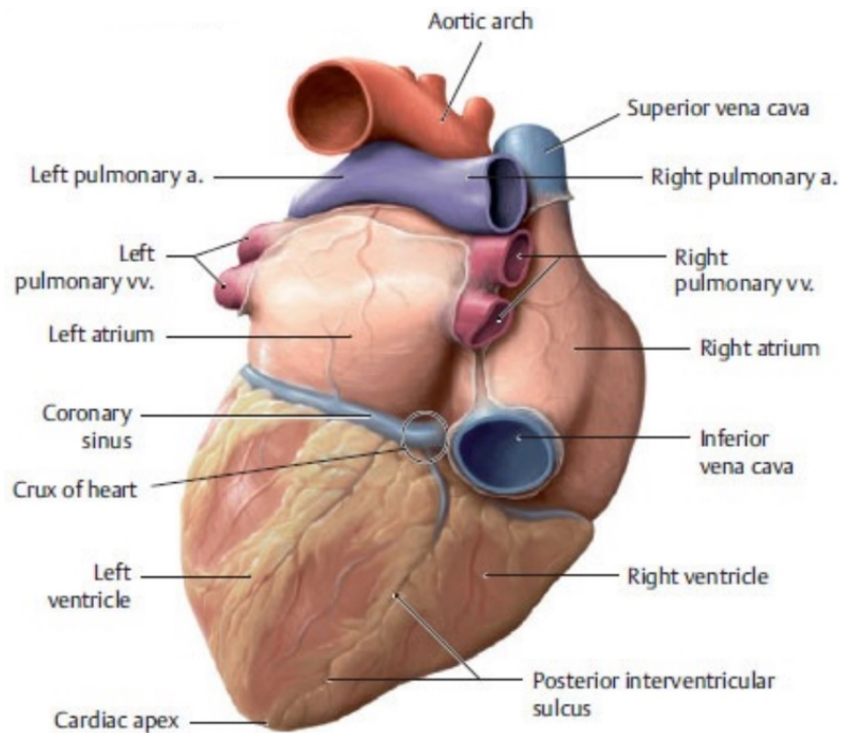


- ▶ **pericardial** space in pericardial sac between parietal and visceral layers of serous pericardium
  - filled with serous fluid allow for frictionless movement of heart
  - two pericardial recesses
    - transverse pericardial sinus passage between inflow channels (superior vena cava and pulmonary veins) and outflow channels ( aorta and pulmonary trunk)
    - oblique pericardial sinus, between right and left pulmonary veins
- ▶ **heart**, hollow organ within pericardial sac, rests on central tendon, has a conical shape.



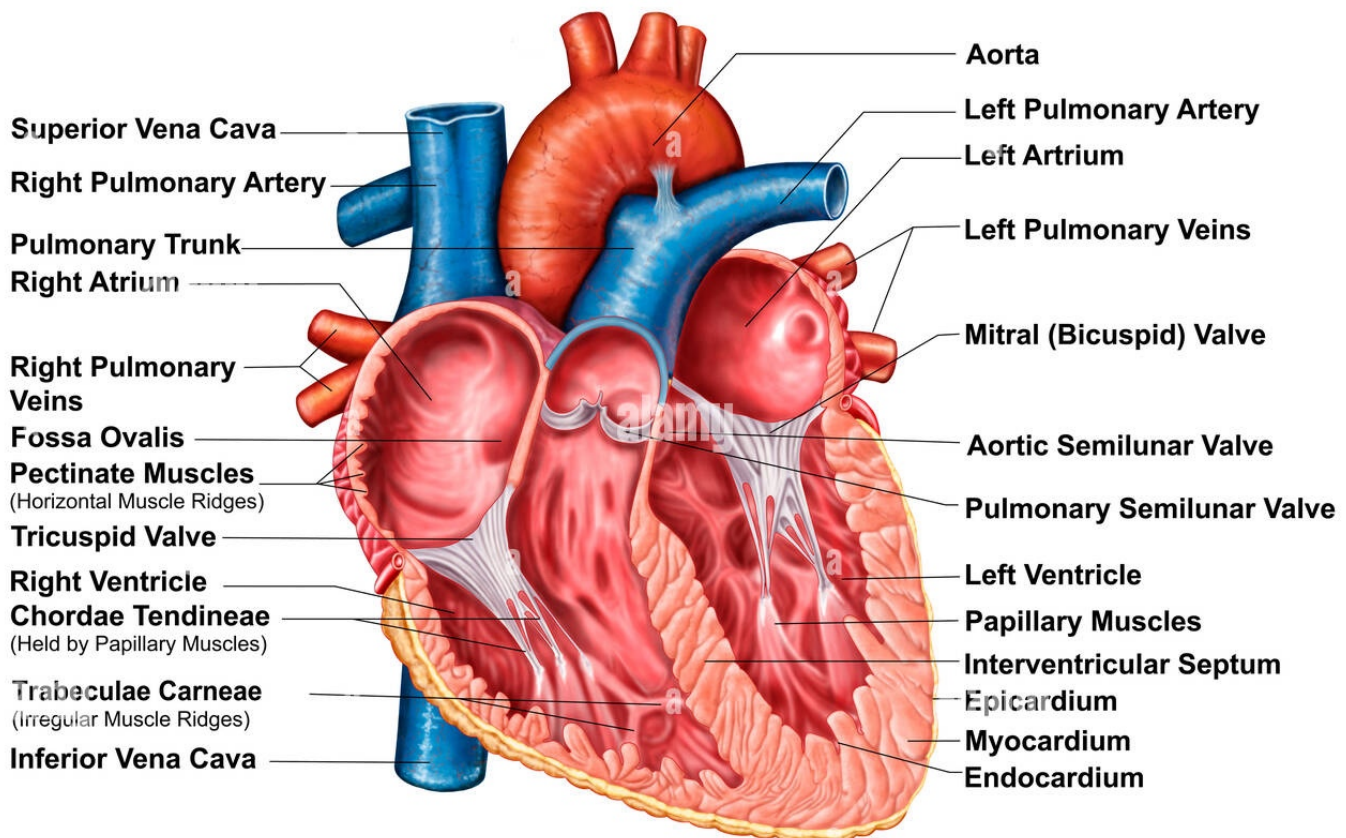
- base - anchored by great vessels
- apex - located @ 5th intercostal space, moves freely within pericardial sac
- 4 chambers
  - right and left atria, are inflow chambers. right receive blood from systemic circulation and left from pulmonary circulation
  - right and left ventricles, are outflow chambers. blood flows from right ventricle to pulmonary circulation and left ventricle to systemic circulation.
- surfaces of heart
  - base - posterior
  - sternocostal surface - anterior
  - diaphragmatic surface - inferior
- borders of heart (Tab 5.2)
- 3 grooves to determine position of chambers
  - coronary sulcus - encircles heart, oblique orientation, vertical
  - anterior interventricular sulcus - longitudinal groove on anterior surface
  - posterior interventricular sulcus - longitudinal groove on diaphragmatic surface





- **crux** - a point where coronary (atrioventricular) and interventricular sulci meet. marks the junction of 4 heart chambers
- 3 layers of wall:
  - epicardium - thin outermost layer
  - myocardium - thick layer of cardiac muscle
  - endocardium - thin internal layer
- **atria**, smooth thin-walled inflow chamber of heart
  - right atrium receives superior and inferior venae cavae from systemic circulation and cardiac veins from heart.
    - its divided into 2 parts by muscular ridge known as terminal crest
      - venous sinus - a smooth walled region, contains: superior and inferior vena cava, coronary sinus, and anterior cardiac veins
      - atrium proper - contains pectinate muscles
  - left atrium receives pulmonary veins from lungs
  - is smaller but thicker walled and receives 4-5 pulmonary veins from the lungs
- **Ventricles**, thick walled chambers connecting to outflow channels of the heart: right ventricle to pulmonary artery and left ventricle to aorta
  - right ventricle - smaller and thinner walled. its separated into 2 parts by supraventricular crest
    - right ventricle proper is the inflow portion of ventricle that receives blood from right atrium
    - conus arteriosus (infundibulum) - smooth walled outflow channel through which blood flows into pulmonary trunk
  - left ventricle, which includes apex of the heart, is thickest walled chamber of the heart. left is divided into inflow and outflow portions:
    - left ventricle proper, which receive blood from left atrium.
    - aortic vestibule, smooth walled outflow channel through which blood flows into aorta
- **Valves of Heart**
  - atrioventricular valves separate atria from ventricles and prevent regurgitation of blood into atria during contraction of ventricles

- atrioventricular valves are made up of cusps, thin leaflets with free inner margins
- slender threads called tendinous cords (chordae tendineae) attach at free edges of valve leaflets to papillary muscles in the ventricles. these cords prevent regurgitation of blood during ventricular contraction.
- valves include:
  - tricuspid valve, separates right atrium from right ventricle, composed of anterior, posterior, septal cusps
  - bicuspid (mitral) valve, separates left atrium from left ventricle, composed of anterior, posterior cusps. anterior cusp is continuous with wall of aorta.
- semilunar valves, prevent outflow from ventricles as chambers fill and backflow of blood into the ventricles after it has been expelled.
  - each valve is made up 3 semilunar cusps
    - sinus
    - lunule
    - nodule
  - valves include:
    - pulmonary semilunar valve, on the pulmonary trunk, moderates blood flow through right ventricular outflow channel. Its cusps are in anterior, right, and left positions.
    - aortic semilunar valve, located within aorta immediately adjacent to mitral valve, it moderates blood flow through left ventricular outflow channel. its cusps are in posterior, right, left positions.
    - coronary arteries arise from sinuses above right and left cusps



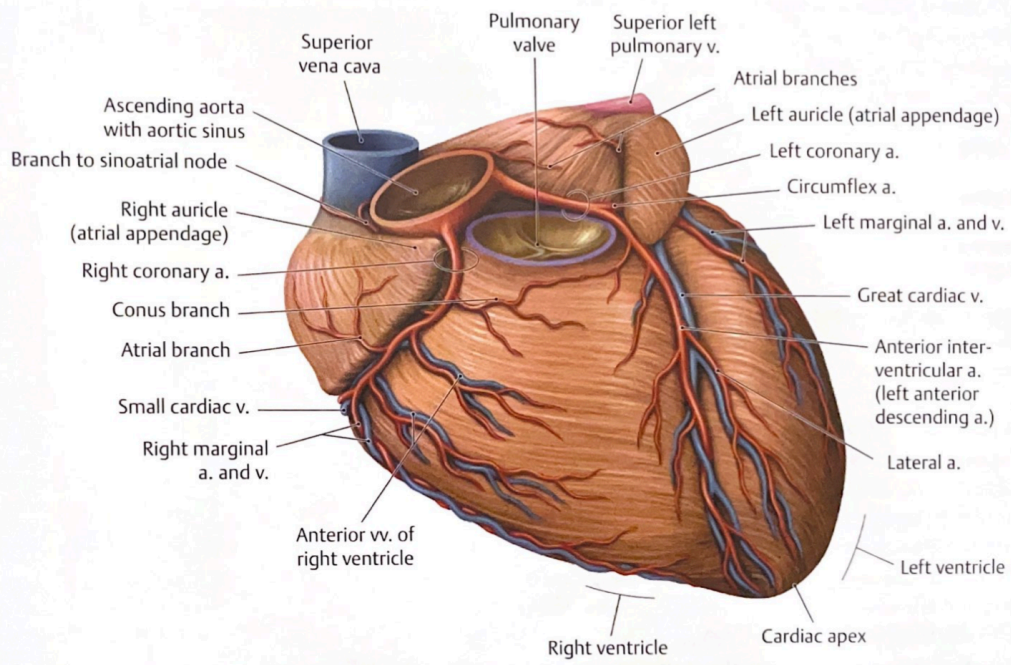
▸ Neurovasculature of the heart

• coronary arteries

- right and left coronary a. arise from ascending aorta. blood flow in the arteries is greatest during diastole (relaxation) because the compression of arteries within the myocardium during systole (contraction)
- these arteries supply myocardium and epicardium of the heart
  - right coronary a. descends within coronary sulcus.
    - major branches:
      - SA nodal a. : supply right atrium and SA (sinoatrial) node
      - right marginal branch: supplies apex and part of right ventricle
      - posterior interventricular branch: supplies right and left ventricles and posterior 3rd of interventricular septum and anastomoses with interventricular branch of left coronary a. near apex on diaphragmatic surface
      - AV nodal a. : supplies AV (atrioventricular) node
  - left coronary a. is larger and arises from aorta posterior to pulmonary trunk. it divides into 2 large branches
    - anterior interventricular (left anterior descending, LAD) a. which descends in the anterior interventricular sulcus
      - supplies anterior right and left ventricles and anterior 2/3 of interventricular septum
    - circumflex a. runs around left side in coronary sulcus their branches and distributions include:
      - supplies left atrium, via left marginal branch, left ventricle.

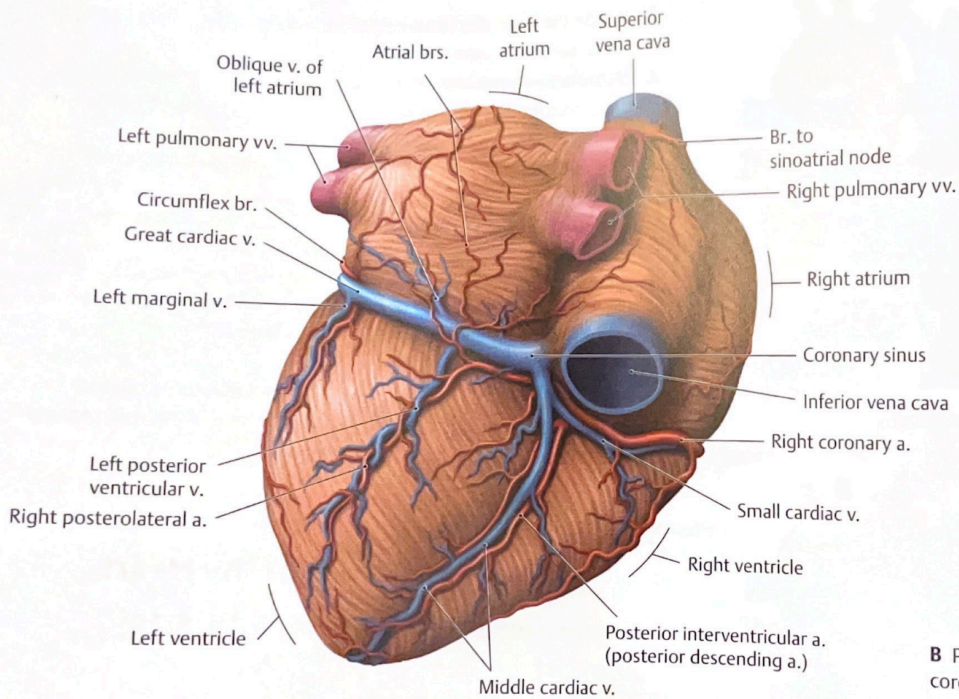
• coronary veins

- coronary sinus receives most of venous return from heart, runs in posterior coronary sulcus between left atrium and ventricle. drains into right atrium near opening of inferior vena cava
- large veins of heart are tributaries of coronary sinus
  - great cardiac vein travels with anterior interventricular a. & drains left atrium and both ventricles
  - posterior left ventricular v. drains diaphragmatic surface of left ventricle
  - posterior interventricular (middle cardiac) v. runs with same a. and drains posterior part of interventricular septum
  - small cardiac v. drains posterior right atrium and right ventricle, accompanies right coronary a.
- anterior cardiac v. drain anterior surface of right ventricle and open directly into right atrium



A Anterior view.

Fig. 5.17 Coronary arteries and cardiac veins (continued on page 96)



B Posteroinferior view. Note: The right and left coronary arteries typically anastomose posteriorly at the left atrium and ventricle.

Fig. 5.17 (continued) Coronary arteries and cardiac veins



▸ coronary lymphatics

- receive lymph from myocardium and epicardium
- follow the right coronary a. to empty into anterior mediastinal nodes and follow left coronary a. to empty into tracheobronchial node.

▸ lymphatic drainage of heart

- left atrium and ventricle --> left coronary trunk --> inferior tracheobronchial nodes ----> then drain to right venous junction via bronchomediastinal trunk
- right ventricle and atrium --> right coronary trunk --> ascending aorta --> brachiocephalic nodes near left venous junction
- pericardium --> right and left venous junctions via superior phrenic nodes

▸ Innervation of heart

- autonomic nerves of the cardiac plexus innervate conduction system of heart and regulate heart rate but do not initiate the heartbeat

○ posterior mediastinum

• superior mediastinum

- many large a. & v. of thorax pass through superior and posterior mediastinum in route to neck or abdomen. They are accompanied by vagus, phrenic, and cardiac n.

- **esophagus** thoracic segment of GI tract, narrow, muscular tube. connects pharynx to stomach

- descends anterior in posterior mediastinum. lies posterior to trachea and inferiorly, lies posterior to left atrium of heart

- upper esophagus is composed of striated muscle arranged in inner circular and outer longitudinal layers. inferiorly these striated muscles are replaced with smooth muscle fibers

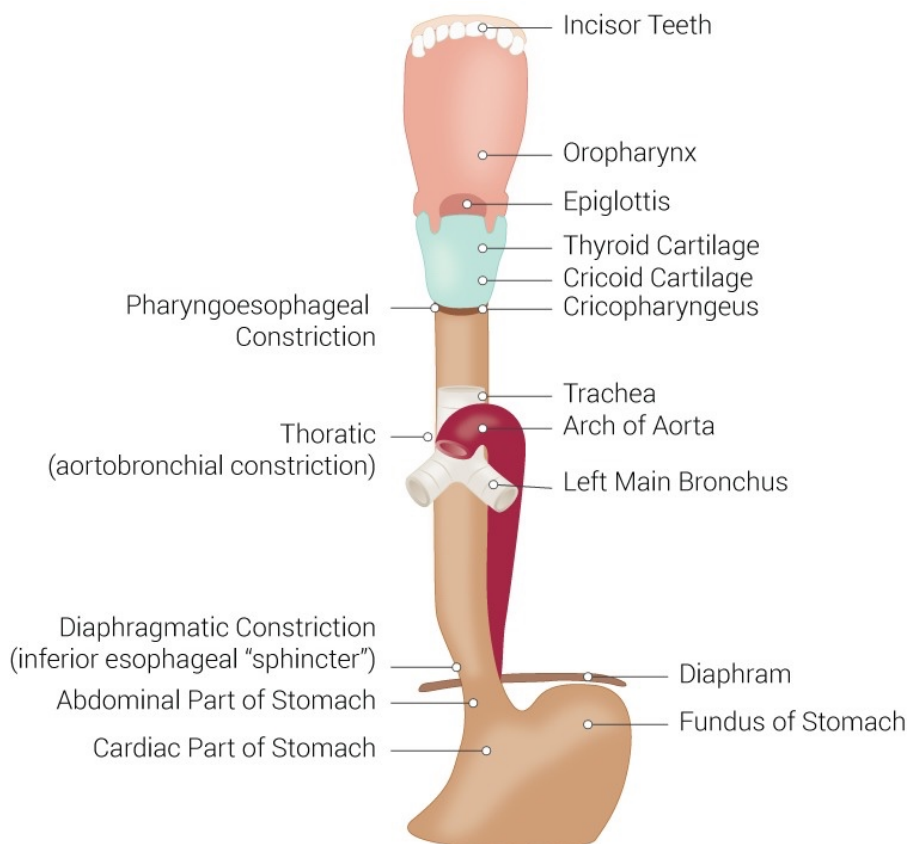
- **3 constrictions** narrow the lumen of esophagus

- upper esophageal sphincter: created by cricopharyngeus muscle

- middle esophageal constriction created by aortic arch and left main bronchus

- lower esophageal constriction (cardiac sphincter) created by circular muscles of distal esophagus

- blood supply arise from vessels in neck (inferior thyroid), thorax (esophageal branches of descending aorta), and abdomen (left gastric

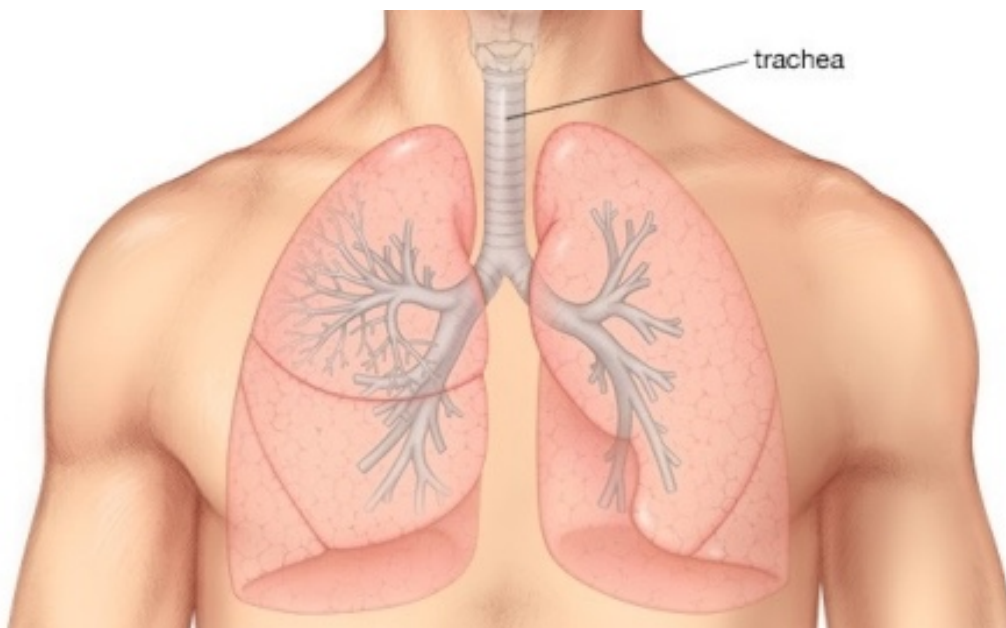


and left inferior phrenic)

- veins upper and middle esophagus drain to azygos system, lower drain into hepatic portal system (venous drainage for organs of abdominal GI tract)
- esophageal plexus is formed by right and left vagus n. with contributions from greater splanchnic n., innervates esophagus

#### ○ trachea and bronchi

- Trachea – located superior mediastinum; which is a region of the body located between the lungs.
- Tracheobronchial tree - a passageway for air between the lungs and external environment
  - The distal part of this passageway is the bronchial tree, which extends into the lungs.
- Trachea lies anterior to esophagus and posterior to great vessels
  - skeleton is formed by C-shaped cartilaginous rings and prevent collapse of the lumen. The rings are connected posteriorly by a muscular membrane
  - carina, a wedge-shaped cartilage, marks bifurcation (division) of the trachea into the left and right bronchus which occurs at T4-T5 vertebral level.
  - right side is shorter, wider, and more vertical also more prone to obstruction by foreign objects
  - supplied by descending branches of the inferior thyroid artery in the neck & bronchial arteries arising from the descending aorta.
  - innervated via the pulmonary plexus by thoracic splanchnic nerves and parasympathetic fibers from the Vagus n. (CN X).

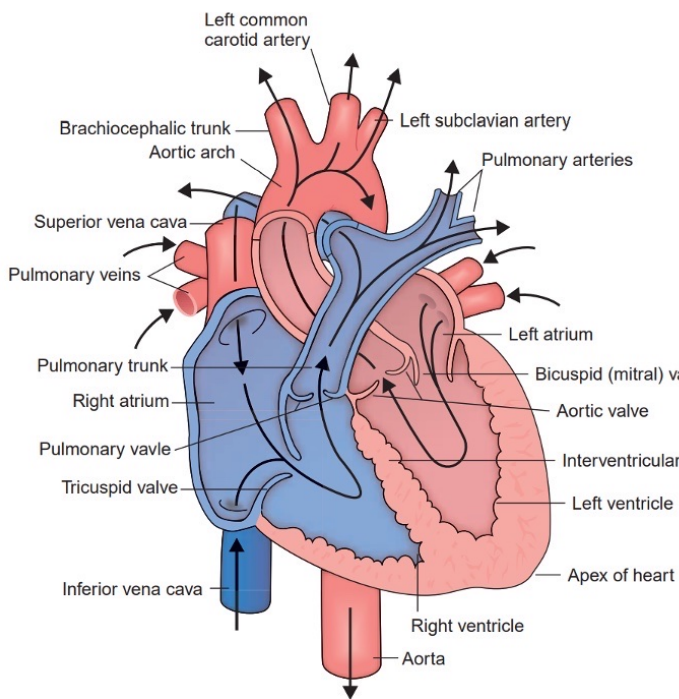


## High yielders:

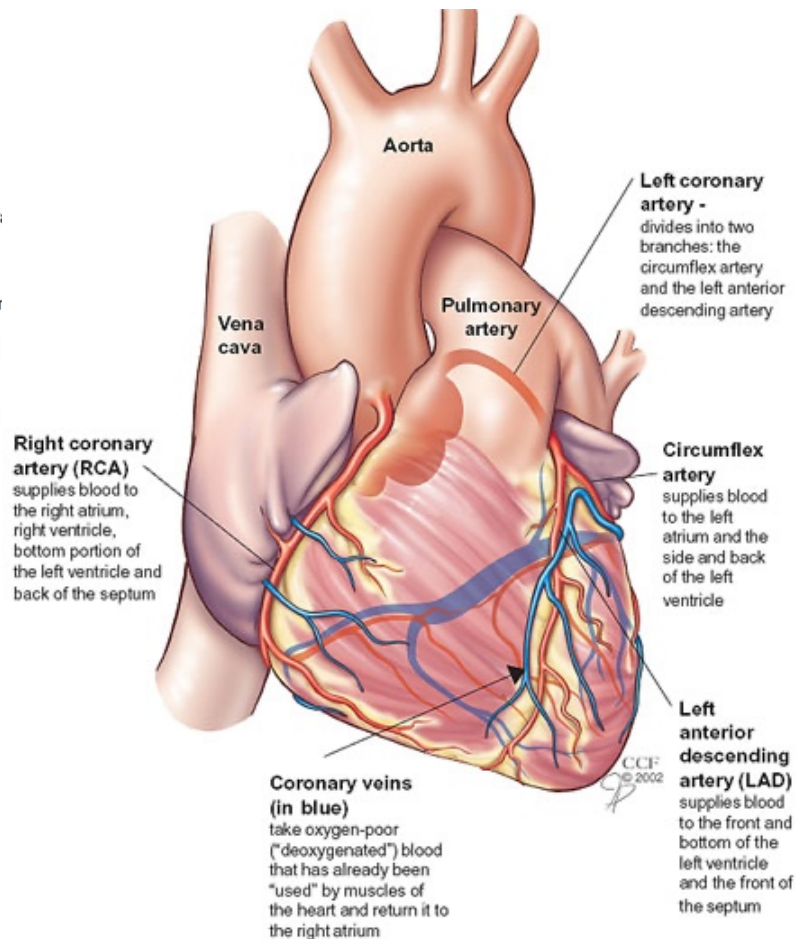
- classification and components of mediastinum
- internal anatomy of the heart
- coronary a. and veins
- overview of thorax

## High yielders

- Table 7.1 in the book: chambers/contents in the mediastinum ok
- Thoracic duct: drains everything but upper right portion of your body (pg 77)
- Fibrous pericardium: continuous with outer layer of greater vessels
- Visceral: touches an organ
- Table 7.2 in the book: borders of the heart - ok
- Table 7.3 in the book: position and auscultation sites of cardiac valves - ok
- Widow maker: blockage of the left anterior descending artery (heart attack)
- Table 7.4: branches of coronary arteries - ok
- Deep cardiac plexus

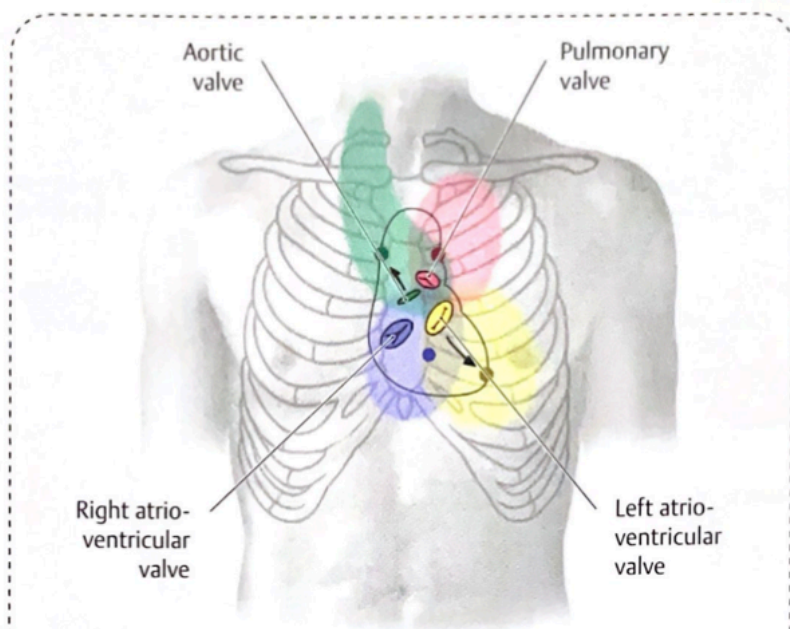


## cardiac circulation with pulmonic circulation



**Table 5.4** Branches of the Coronary Arteries

Left coronary artery circumflex a.	Right coronary artery branch to sinoatrial node
• Atrial branch	Conus branch
• Left marginal a.	Atrial branch
• Posterior left ventricular a.	Right marginal a.
Anterior interventricular a. (left anterior descending a.)	Posterior interventricular (descending) a.
• Conus branch	• Interventricular septal branches
• Lateral branch	Branch to atrioventricular node
• Interventricular septal branches	Right posterolateral a.



**Table 5.3** Position and Auscultation Sites of Cardiac Valves

Valve	Anatomical Projection	Auscultation Site
Aortic valve	Left sternal border (at level of 3rd rib)	Right 2nd intercostal space (at sternal margin)
Pulmonary valve	Left sternal border (at level of 3rd costal cartilage)	Left 2nd intercostal space (at sternal margin)
Left atrioventricular valve	Left 4th/5th costal cartilage	Left 5th intercostal space (at midclavicular line) or cardiac apex
Right atrioventricular valve	Sternum (at level of 3rd costal cartilage)	Left 5th intercostal space (at sternal margin)

*Note:* Auscultation sites of the cardiac valves, indicated by colored dots. Valvular heart disease causes turbulent blood flow through a valve; this produces a murmur that may be detected in the colored region around the valve.

**Table 5.2 Borders of the Heart**

<b>Border</b>	<b>Defining Structures</b>
Right cardiac border	Right atrium Superior vena cava
Apex	Left ventricle
Left cardiac border	Aortic arch ("aortic knob") Pulmonary trunk Left atrium Left ventricle
Inferior cardiac border	Left ventricle Right ventricle

